WE CLAIM:

1. A simultaneous vaporization and ionization spectrometry source, comprising:

an electrically conductive conduit configured to receive particulate sample carried by a carrier fluid stream, the conduit comprising a discharge end having an opening configured to discharge the sample into a spectrometry analyzer; and

an electrically conductive reference device positioned proximate the discharge end of the conduit at a distance therefrom sufficient to allow an electrical potential to be established between the conduit and the reference device.

2. The simultaneous vaporization and ionization spectrometry source of claim 1 wherein the distance between the conduit and the reference device is greater than the Paschen distance.

3. The simultaneous vaporization and ionization spectrometry source of claim 1 wherein the electrically conductive reference device is positioned proximate the discharge end of the conduit such that the arrival of particulate sample proximate the discharge end opening initiates a corona discharge at the discharge end of the conduit in response to a sufficient electrical potential being maintained between the conduit and the reference device.

4. The simultaneous vaporization and ionization spectrometry source of claim 1 wherein the conduit is defined by an outer surface, and further comprising an electrically non-conductive shield disposed about at least a portion of the conduit outer surface.

5. The simultaneous vaporization and ionization spectrometry source of claim 4 wherein the non-conductive shield is provided with an opening allowing an electrical conductor to pass through said shield to contact the conduit.

6. The simultaneous vaporization and ionization spectrometry source of claim 1 wherein the reference device comprises a metal selected from the group consisting of stainless steel, platinum, and gold.

7. The simultaneous vaporization and ionization spectrometry source of claim 1 further comprising an electrical circuit configured to establish and maintain an electrical potential between the conduit and the reference device.

8. The simultaneous vaporization and ionization spectrometry source of claim 7 wherein said electrical circuit comprises a voltage selector configured to allow the electrical potential between the conduit and the reference device to be selectively determined.

9. The simultaneous vaporization and ionization spectrometry source of claim 7 wherein the electrical circuit is configured to maintain an electrical potential between the conduit and the reference device of at least about 10 volts.

10. The simultaneous vaporization and ionization spectrometry source of claim 7 wherein the electrical circuit is configured to maintain an electrical potential between the conduit and the reference device of less than about 250 volts.

11. The simultaneous vaporization and ionization spectrometry source of claim 1 wherein the conduit is electrically grounded.

12. The simultaneous vaporization and ionization spectrometry source of claim 1 wherein the conduit comprises a hypodermic needle.

13. The simultaneous vaporization and ionization spectrometry source of claim 1 wherein the reference device is ring-shaped and is positioned between the conduit discharge end and the spectrometry analyzer.

14. The simultaneous vaporization and ionization spectrometry source of claim 1 wherein the reference device comprises a grid comprising a plurality of openings disposed therein to allow vaporized, ionized sample to pass from the discharge end of the conduit into the spectrometry analyzer.

15. A spectrometer comprising:

a spectrometry analyzer; and

a simultaneous vaporization and ionization spectrometry source, the source comprising:

an electrically conductive conduit configured to receive particulate sample carried by a carrier fluid stream, the conduit comprising a discharge end having an opening configured to discharge the sample into the spectrometry analyzer; and

an electrically conductive reference device positioned proximate the discharge end of the conduit at a distance therefrom sufficient to allow an electrical potential to be established between the conduit and the reference device.

16. The spectrometer of claim 15 wherein the distance between the conduit and the reference device is greater than the Paschen distance.

17. The spectrometer of claim 15 wherein the electrically conductive reference device is positioned proximate the discharge end of the conduit such that the arrival of particulate sample proximate the discharge end opening initiates a corona discharge at the discharge end of the conduit in response to a sufficient electrical potential being maintained between the conduit and the reference device.

18. The spectrometer of claim 15 further comprising a control circuit configured to generate pulses of electrical potential between the conduit and the

electrically conductive reference device sufficient to produce periodic electrical arcing there between.

19. The spectrometer of claim 15 further comprising a control circuit configured to generate an electrical potential between the conduit and the electrically conductive reference sufficient to produce continuous electrical discharge there between.

20. The spectrometer of claim 15 wherein the spectrometry analyzer is configured to analyze analyte ions in the form of vaporized, ionized sample based on mass of vaporized analyte ions at atmospheric pressure.

21. The spectrometer of claim 15 wherein the spectrometry analyzer is configured to analyze the analyte ions based on ion mobility of vaporized analyte ions.

22. The spectrometer of claim 15 further comprising a sample transport system configured to transport the particulate sample to the discharge opening of the conduit in a carrier fluid.

23. The spectrometer of claim 15 wherein the conductive reference device comprises a sheathed conductive filament disposed within the conduit, and having an unsheathed tip positioned proximate the discharge end of the conduit.

24. The spectrometer of claim 23 wherein the sheathed conductive filament comprises an insulated wire.

25. The spectrometer of claim 15 wherein the conductive reference device comprises a conductive probe disposed within the discharge end of the conduit.

26. The spectrometer of claim 15 further comprising a sweep gas system for removing non-ionized particles from a region around the simultaneous vaporization and ionization spectrometry source prior to the introduction of ionized particles into the spectrometry analyzer.

27. The spectrometer of claim 15 further comprising an electrical circuit configured to establish and maintain an electrical potential between the conduit and the reference device.

28. The spectrometer of claim 27 wherein said electrical circuit comprises a voltage selector configured to allow the electrical potential between the conduit and the reference device to be selectively determined.

29. The spectrometer of claim 27 wherein the electrical circuit is configured to maintain an electrical potential between the conduit and the reference device of at least about 10 volts.

30. The spectrometer of claim 27 wherein the electrical circuit is configured to maintain an electrical potential between the conduit and the reference device of less than about 250 volts.

31. The spectrometer of claim 15 wherein the spectrometry analyzer comprises an ion mobility spectrometry analyzer.

32. The spectrometer of claim 15 wherein the spectrometry analyzer comprises an atmospheric pressure ionization mass spectrometry analyzer.

33. A method for simultaneous vaporization and ionization of particulate sample to produce analyte ions for spectrometric analysis, comprising:

providing a particulate sample to be spectrometrically analyzed;

providing a first electrode;

providing a second electrode proximate the first electrode;

maintaining a first electrical potential at the first electrode, and a second electrical potential at the second electrode, such that an electrical potential exists there between;

providing a carrier fluid for transporting the particulate sample to a point proximate the first and second electrodes;

transporting the particulate sample via the carrier fluid to a point proximate to the first and second electrodes;

causing electrical arcing between the first and second electrodes at a time when the particulate sample arrives thereat to cause at least partial vaporization and ionization of the particulate sample to produce analyte ions.

34. The method of claim 33 wherein the electrical potential between the first and second electrodes is maintained slightly above a breakdown potential there between, and the electrical arcing between the first and second electrodes is caused by the presence of the particulate sample thereat altering the breakdown potential, resulting in a corona discharge causing at least partial vaporization and ionization of the particulate sample to produce analyte ions.

35. The method of claim 33 wherein the electrical potential between the first and second electrodes is maintained such as to produce a continuous arcing there between, thereby causing continuous at least partial vaporization and ionization of the particulate sample to produce analyte ions.

36. The method of claim 33 wherein the electrical potential between the first and second electrodes is initially maintained at a level below a breakdown potential there between, the method further comprising the step of periodically increasing the potential between the first and second electrodes to cause periodic corona discharge thereat resulting in at least partial vaporization and ionization of the particulate sample present at the electrodes at the time of discharge, to produce analyte ions.

37. A method for simultaneous vaporization and ionization of particulate sample to produce analyte ions for spectrometric analysis, comprising:

providing a particulate sample to be spectrometrically analyzed;

providing a first electrode;

providing a second electrode proximate the first electrode;

providing a carrier fluid for transporting the particulate sample to a point proximate the first and second electrodes;

transporting the particulate sample via the carrier fluid to a point proximate to the first and second electrodes;

maintaining a first electrical potential at the first electrode, and a second electrical potential at the second electrode at a point above a breakdown potential there between such that the arrival of the particulate sample at the point proximate to the first electrode causes a corona discharge as a result of altering the breakdown potential, the corona discharge causing at least partial vaporization and ionization of the particulate sample to produce analyte ions.

38. The method of claim 33 wherein the carrier fluid is a gas.

39. The method of claim 33 further comprising the step of analyzing the analyte ions using a spectrometry analyzer.

40. The method of claim 34 further comprising the step of adjusting at least one of the first or the second potentials to cause a corona discharge in the absence of particulate sample at the point proximate to the first and second electrodes, and then altering the potential of at least one of the first or the second potentials to create an equilibrium state between the first and second potentials where no corona discharge occurs in the absence of particulate sample at the point proximate to the first and second electrodes.

41. The method of claim 37 further comprising the step of adjusting at least one of the first or the second potentials to cause a corona discharge in the absence of analyte ions at the point proximate to the first electrode, and then increasing the potential of at least one of the first or the second potentials to create a voltage potential difference between the electrodes of between about 10 and 50 volts.

42. The method of claim 33 wherein the steps are performed within an ion mobility spectrometer.

43. The method of claim 33 wherein the steps are performed within an atmospheric pressure ionization mass spectrometer.